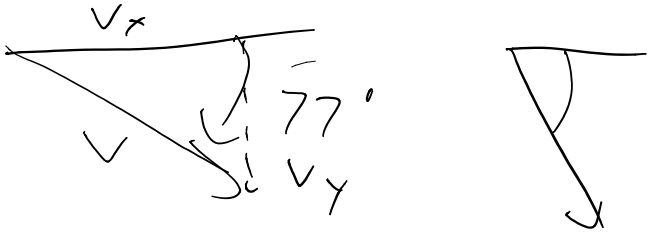
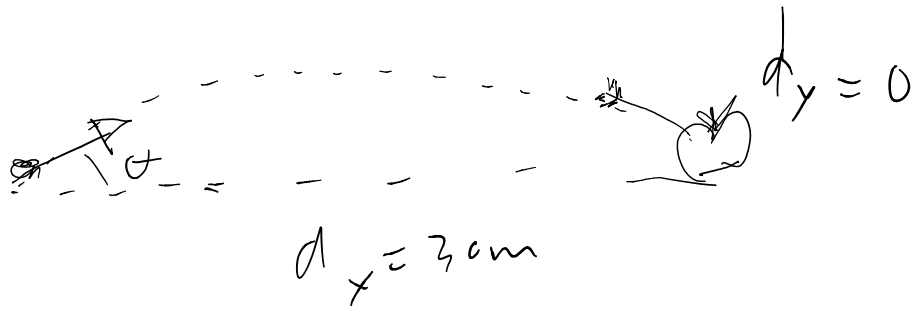
go over projectile questions
free body diagram worksheet
take home lab simulation activity
shirley off cliff at 4.0 m/s 35.0 degrees above the horizontal
vyi = 4xSin(35)=2.294305745404184
vx = 4xCos(35)=3.276608177155967
$a=-9.80 m/s^2$
d=-10.0m
$d=1/2gt^2 + vyit$
$-10=-4.9t^2 + 2.294\ t$
14.187
$t = -2.294+/-root(2.294^2-(4x-4.9x10))/-9.8$
t=(-2.294-14.187)/-9.8= 1.682s

dx = vxt = 3.2766x1.682=5.5112
= 5.5m

vyf= vyi + at = 2.294
+(-9.8x1.682)=-14.1896 m/s
vx= 3.2766m/s
$v^2=(14.1896^{\wedge 2}+3.2766^{\wedge 2})=$
v=14.56m/s
direction $\theta = \tan^{-1}(14.1896/3.2766)$
= 77degrees below horizontal



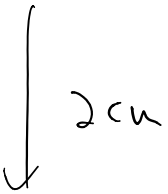
Quiz October 17th vectors and projectiles
p63
Q45
d_x=30.0m
horizontal d_y=0
θ=?
v=35m/s
$v_x=v\cos\theta$
$v_y=v\sin\theta$

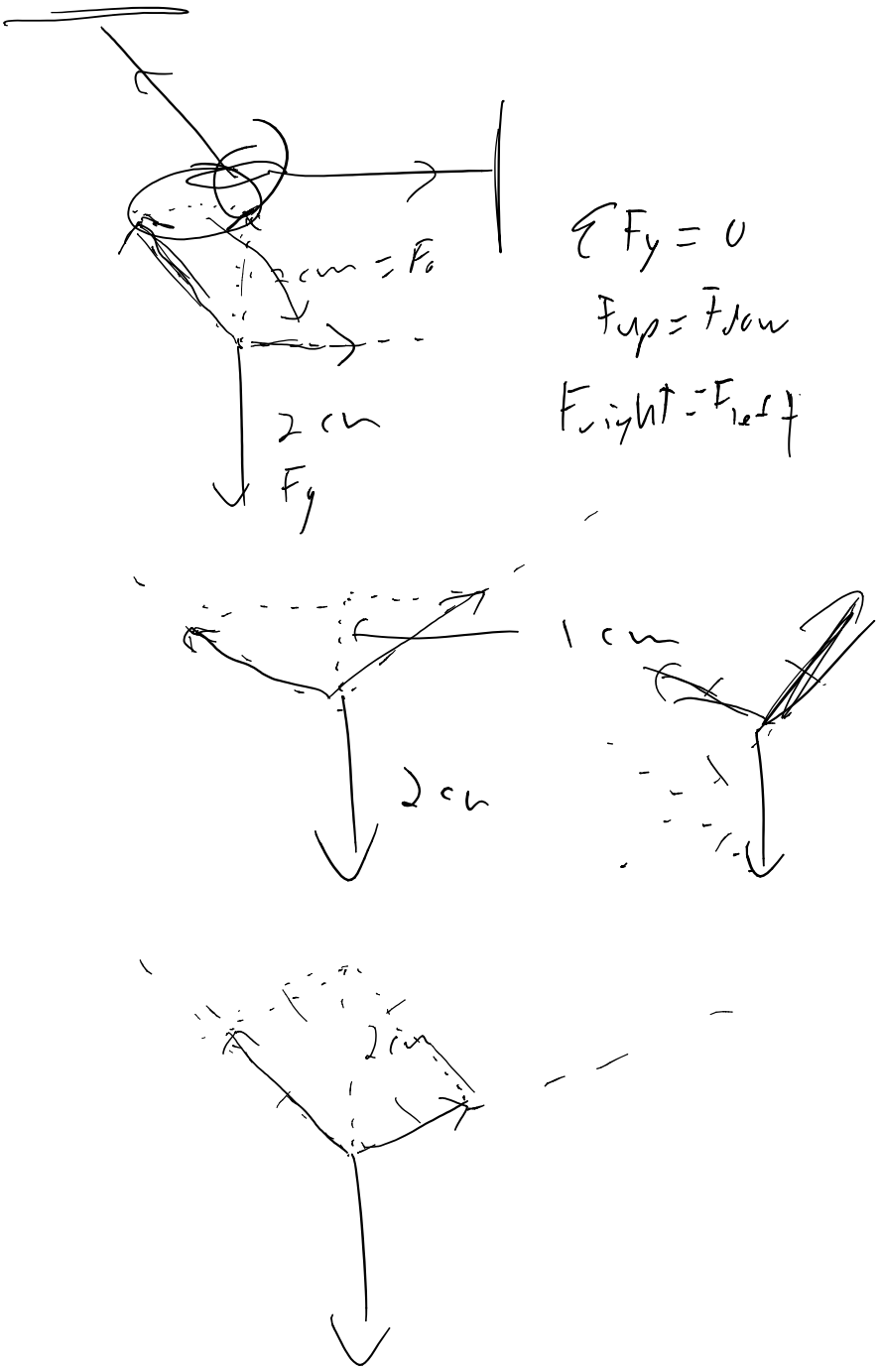


$d_x = v_x t = 30 = v_x t = t = 30/vx$
$d_y = 1/2\ gt^2 + V_{yi}t = 0 = -4.9t + v_{yi}$
sub in
$0 = -4.9(30/vx) + vyi$
$vyivx = 4.9x30 = 147 = v^2 \sin q \cos q$
trig identity $2\sin q \cos q = \sin 2q$
$147 = v^2\ 1/2 \sin 2q$
$147 = (35)^2\ 1/2 \sin 2q$
$0.12 = 1/2 \sin 2q$
$0.24 = \sin 2q$
$\sin^{-1} 0.24 = 13.887 = 2q$
$q = 6.9$degrees
woohoo

assignment
p64 Q55, 57, 59

Handouts:
1. play with a projectile motion applet at home on a computer
2. Free body diagrams - must be to scale use 2.0 cm for Fg





go over projectile questions
free body diagram worksheet
take home lab simulation activity

Fred, Ted and Ned jumped off the cliff.
determine t, v, dx
Ned jumps at 4.00 m/s at 35.0 degrees above the horizontal off a 10.0m high cliff.

break the problem into x and y motion
$V_x = V\cos\theta$

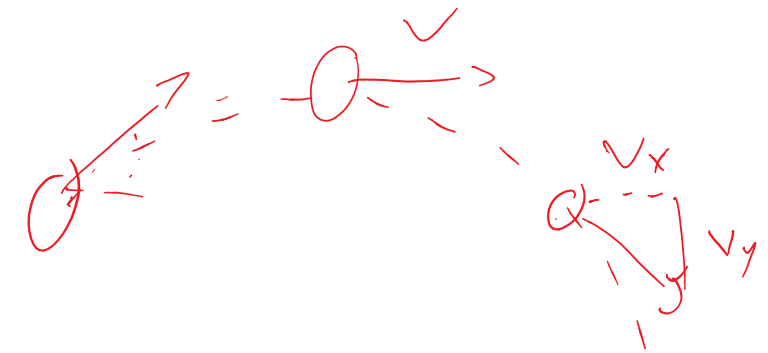
$v_y = v \sin \theta$
$v_x = 4 \times \cos(35) = 3.276608177155967$
$v_{yi} = 4 \times \sin(35) = +2.294305745404184$
$a = g = -9.80 m/s^2$
$dy = -10.0m$

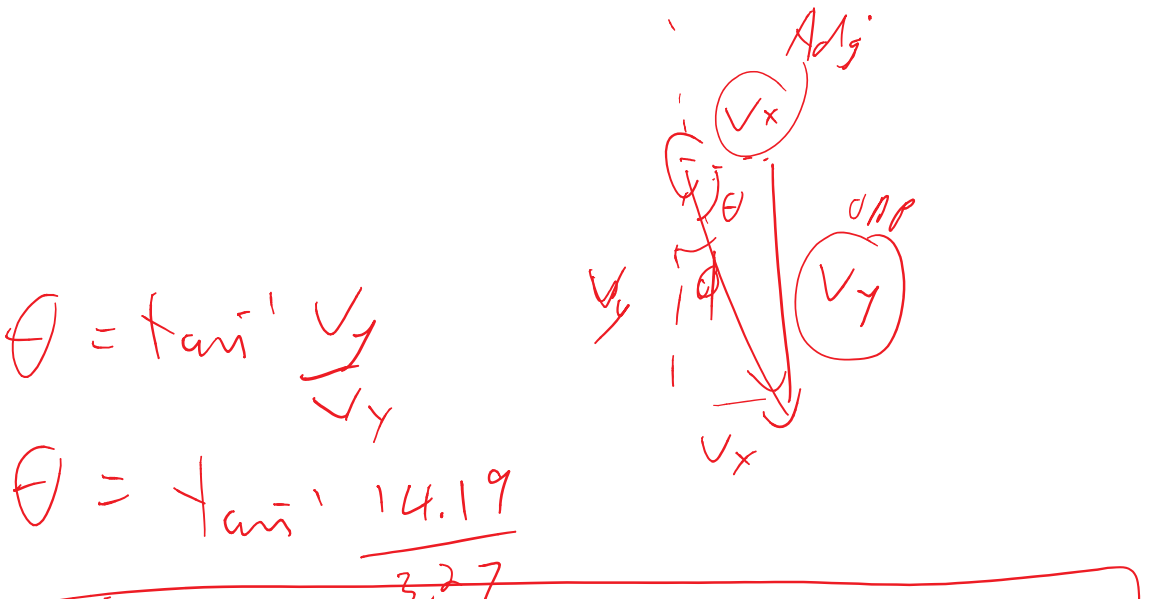
$d_y = 1/2at^2 + v_{yi}t$
$-10 = -4.9t^2 + 2.2943\ t$
$0 = -=4.9t^2 + 2.2943\ t + 10$
$-b +/- root(b^2 - 4ac)/2a$
$-2.294 +/- root(2.294^2 - 4(-4.9)10)/2(-4.9)$

$t = 1.68174s = 1.68s$

$d_x = v_x t = 4 \cos 35 \times 1.68 = 5.5m$

$v_y = at + v_{yi} = (-9.8 \times 1.68174) + 2.294$
$= -14.18705$
$v = root\ vx^2 + vy^2 = root\ 3.277^2 + 14.187^2$
$v = 14.56 m/s$
direction:



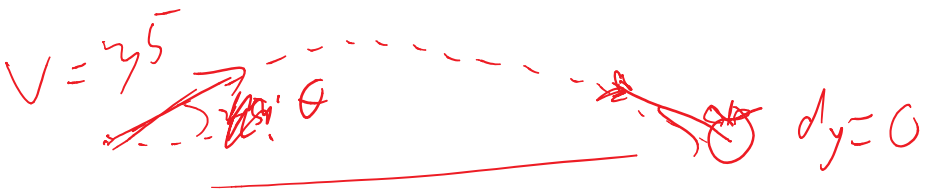


$v = \frac{14.1}{3.27}$

$\theta = 77°$ below horizontal

or $\phi = 13°$ from vertical

p62
Q45



$d = 30m$

$d_x = V_x t + d_y t + \frac{1}{2} a t^2 + V_{yi} t$

$t = \frac{d_x}{V_x}$

$0 = \frac{1}{2} g t^2 + V_{yi} t$

$0 = \frac{1}{2} g t + V_{yi}$

$0 = (-)4.9\left(\frac{30}{V_x}\right) + V_{yi}$

$$0 = -4.9\left(\frac{30}{V_x}\right) + V_{yi}$$

$$V_{yi} V_x = 4.9(30)$$

$V\sin\theta \; V\cos\theta = 147$

$V^2 \sin\theta\cos\theta = 147$

identity $2\sin\theta\cos\theta = \sin 2\theta$

$$V^2 \frac{\sin 2\theta}{g} = 147$$

$$(35\,m/s)^2 \frac{\sin 2\theta}{g} = 147$$

$$\frac{\sin 2\theta}{g} = 0.12$$

$$\sin 2\theta = 0.24$$

$$2\theta = \sin^{-1} 0.24$$

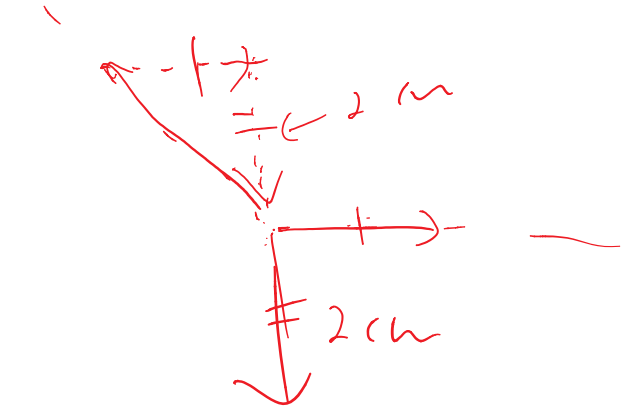
$$2\theta = 13.8^\circ$$

$$\theta = 6.9^\circ$$

do the projectile sheet first-
check next class
free body diagrams

check next class
free body diagrams

make Fg = 2.0 cm and draw
the force vectors to scale



100 cos37

47 d) $V_x = 79.86355$

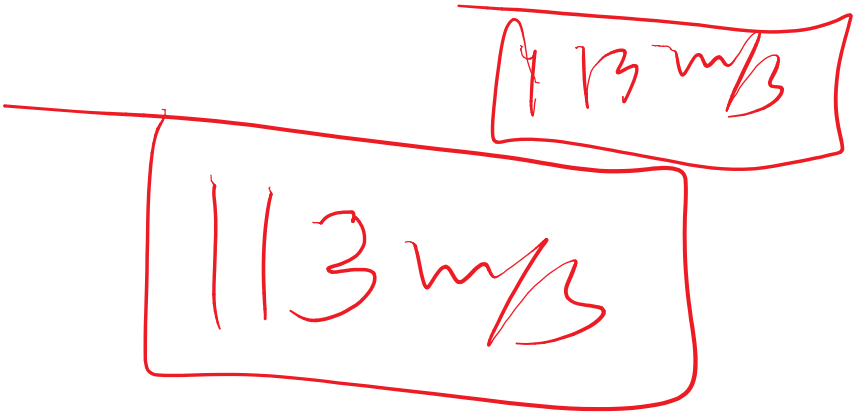
$V_{yi} = 60.1415$

$V_{yf}^2 = V_{yi}^2 + 2(-9.8)(-140)$

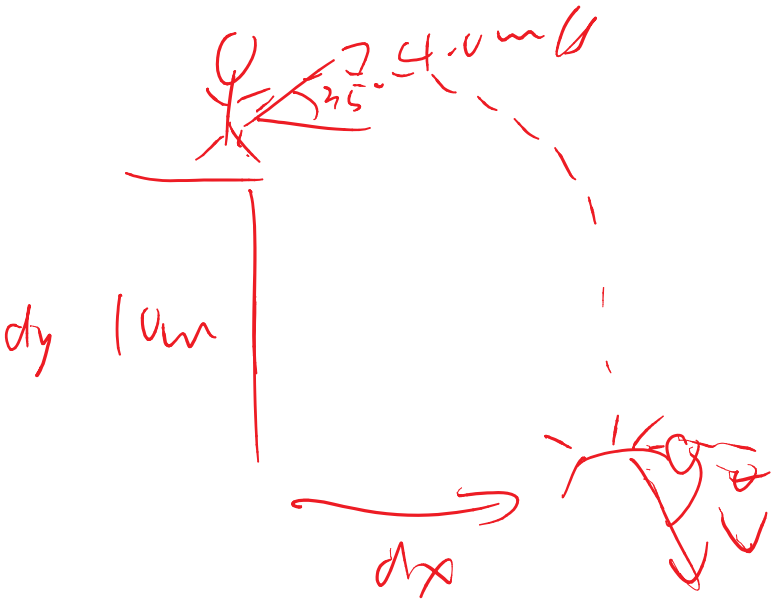
$V_{yf} = 79.786$

$V = \sqrt{79.786^2 + 79.8^2}$

$= 112.88$



angela, edward ran,
Mr. K. jumped off the 10.0m high cliff at 4.00m/s at 35.0degrees above the horizontal.
determine t, dx, v and θ



separate the problem into x and y components
x motion is constant velocity $d_x=v_xt$
y motion is constant acceleration, $g=9.80m/s^2$
4 equations $d_y=1/2gt^2 + v_{yi}t$
$v_y=gt + v_{yi}$
$v_y^2 = v_{yi}^2 + 2gd_y$

$v_{yi} =v\sin\theta = 4xSin(35)=2.294305745404184$
$v_x=v\cos\theta = 4xCos(35)=3.276608177155967$
$d_y = -10.0m$
$a=g=-9.80m/s^2$

d_y

$d_y = 1/2gt^2 + v_{yi}t$

$-10 = -4.9t^2 + 2.2943t$

quadradic

$t = (-2.294 +/- \text{root}(2.294^2 - 4(-4.9)(10)))/-9.8$

$t = 1.68s$

$dx = v\cos\theta\ t = 3.2766 \times 1.68s = 5.5m$

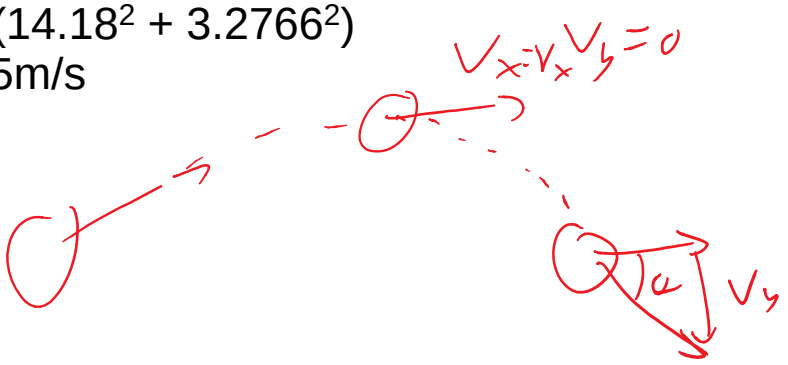
$vyf = vyi + at = 2.294 + 9.8(1.68) = 14.18m/s$

$vx = 3.2766$

$v = \text{root}(vx^2 + vy^2)$

$v = \text{root}(14.18^2 + 3.2766^2)$

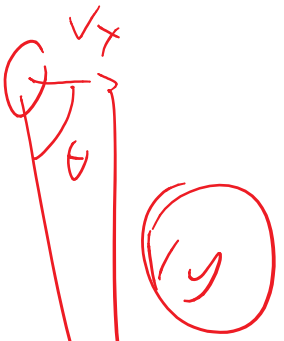
$v = 14.55m/s$



$\theta = \tan^{-1} \frac{V_y}{V_x}$

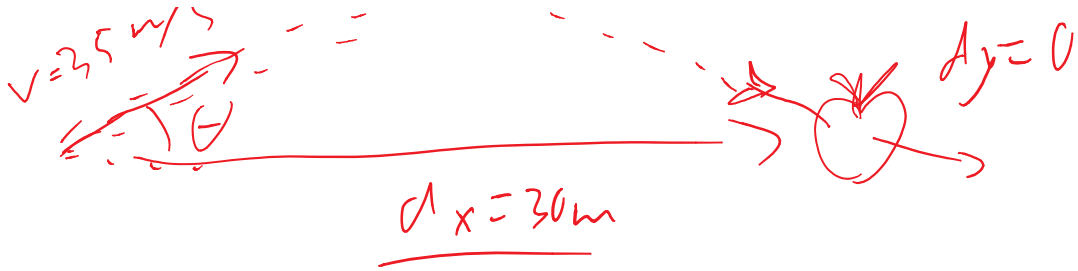
$\theta = \tan^{-1} \frac{14.18}{3.27}$

$\theta = 77°$ below horizontal



p63

Q36 or 45



$\Delta x = 30m$

$\Delta x = V_x t \rightarrow t = \frac{\Delta x}{V_x}$

$\Delta y = V_{yi} t + \frac{1}{2} g t^2$

$\underbrace{0}_{+} = \underbrace{V_{yi} t}_{+} + \underbrace{\frac{1}{2} g t^2}_{+}$

$0 = V_{yi} + \frac{1}{2} g t$

$0 = V_{yi} + \frac{1}{2} g \left(\frac{\Delta x}{V_x}\right)$

$-V_{yi} = \frac{1}{2} g \frac{\Delta x}{V_x}$

$-2 V_x V_{yi} = g \Delta x$

when $\Delta x = -\frac{2 V_x V_{yi}}{g}$ if $\Delta y = 0$

$-2 (V\cos\theta)(V\sin\theta) = 9.8(30)$

$-2V^2 \cos\theta \sin\theta = \frac{9.8(30)}{35^2}$

$2\cos\theta\sin\theta = \frac{9.8(30)}{35^2}$

V^2

trig identities $2\cos\theta\sin\theta = \sin(2\theta)$

$\sin(2\theta) = 9.8 \times 30 / 35^2$

$\sin(2\theta) = 0.24$

$2\theta = \sin^{-1}(0.24)$

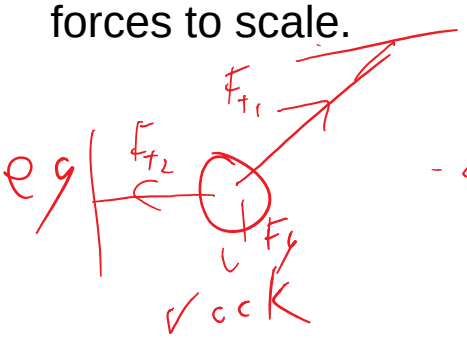
θ= 13.8865/2=6.9433 degrees

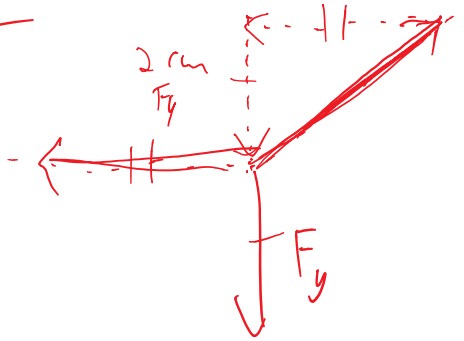
(or 90-6.9=83.1)

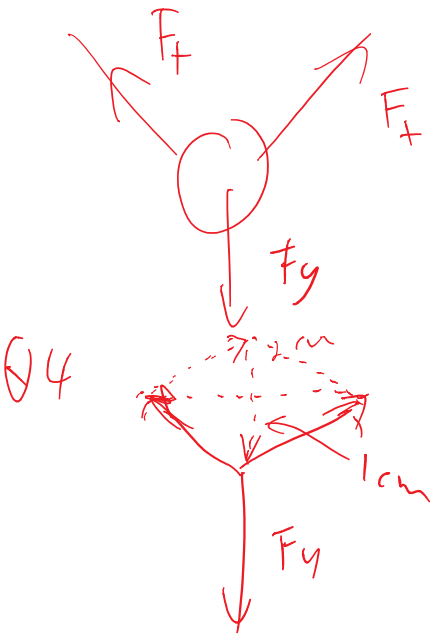
you can solve by $vx^2 + vy^2 = v^2$

Assignments:

1. worksheet explore projectiles in a simulation
2. worksheet draw free body force diagrams to scale with Fg of the rock at 2.0 cm and other forces to scale.







$\Sigma F = 0$

$\Sigma F_y = 0$

$F_{up} = F_{down}$

$F_{weight} = F_{lift}$